The following information is intended to help the sanitarian identify correct food service equipment plumbing installations.

Water Supply Protection

Cross-Connections

A cross-connection is an ACTUAL or POTENTIAL link between the potable water supply and a source of contamination (sewage, chemicals, gas, etc.). A cross-connection can be a temporary or permanent direct connection, by-pass arrangement, jumper connection, submerged inlet, removable section, swivel or change-over device, etc. that could connect a potable system to a non-potable source. Ideally, it is best to not have any cross-connections, but in certain situations they are unavoidable. When an installation requires a cross-connection, it must be properly protected with an acceptable backflow prevention assembly or device to eliminate any potential for a reverse flow back into the potable water supply. An unprotected cross-connection threatens the health and safety of individuals and may contaminate food or beverage products utilizing water from that system.

Two Types of Cross-connections:

Direct Connection: Is a physical connection between a potable and non-potable system. A direct pathway exists between the two separate systems for contamination to be transferred into the potable water system. An example of a direct connection is a pipe installed to connect a potable water line to a sewer line.

Indirect Connection: Is a situation in which, under “normal” conditions, a cross-connection does not exist. However, under “unique” circumstances a pathway for contamination can occur. The source of contamination may be a back-up, be blown across, siphoned, pushed, or diverted into a potable water supply. An indirect connection is only subject to backsiphonage.

Forces Acting on Cross-Connections

Some cross-connections are immediately obvious, but others can be subtle and difficult to find. Contamination occurs when the pressure between the water supply and another system (via some connection) are sufficient to transfer the contaminant into the water supply. These temporary reversals of pressure can be unpredictable.

Backflow

Backflow is a reversal in flow that is opposite to the expected or intended direction. The reversal in flow is undesirable. However, a properly protected system can remain safe. There are two types of backflow: “backpressure” and “back-siphonage”.

> **Backpressure** occurs when both systems (potable & non-potable) are under pressure (above atmospheric pressure). Backflow occurs when the non-potable system has greater pressure than the potable system. This pressure differential pushes the contaminant into the potable supply.
>
> **Back-siphonage** occurs when the pressure in the water supply system drops below atmospheric pressure and the non-potable source is drawn or siphoned into the water supply. Back-siphonage can occur with either a direct or indirect connection and the systems can be either open or closed to the atmosphere. Principle causes include:

1. Undersized sections of pipe can create an aspirator effect in the restricted area.

2. A break or repair in a supply line can create a vacuum (as gravity drains the water out) on the elevated portions of the system above the effected area.

3. A high water withdrawal, such as fire fighting or water main flushing, can create a vacuum. The withdrawal is more likely to create stronger negative pressure at the higher elevation of the system.

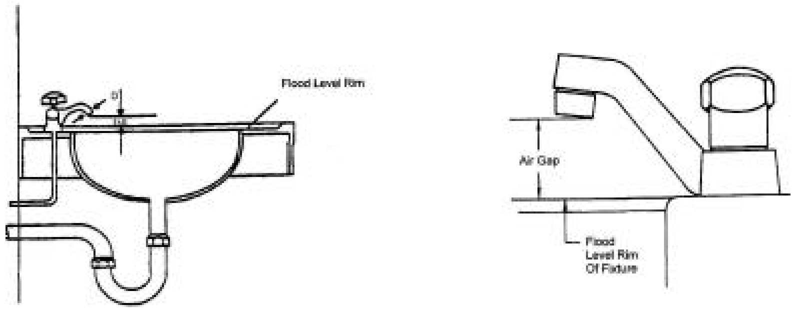
4. A vacuum can be induced on the suction side of a booster pump, such as high-rise buildings and processing plants.

Physical Back flow Prevention Methods

Air Gap

An air gap is the most desirable method of backflow prevention. It is simple, economical, non-mechanical, fail safe, and can be used for potential back-siphonage and backpressure applications. An air gap is the unobstructed vertical air space that separates the end of a supply line and the flood level rim of a receptacle. The receptacle may be a sink, coffee urn, steam kettle, floor drain, floor sink, etc. The air gap must be the greater of the two – a minimum of 1 inch or twice the diameter of the supply pipe.

The following are some air gap applications:



Air Gap And Effective Opening

Ice Cream Dipper Well

Water Fill to Steam Kettle

<u>Mechanical Backflow Assemblies & Devices</u>

The type of mechanical assembly or device selected must be appropriate for the degree of hazard and specific application. Some mechanical backflow preventers consist of single or multiple check valves that open from the flow pressure of the potable water. The valves are fabricated to seat tightly on a machined surface and, when closed, prevent any flow in the wrong direction. Some devices have air inlets or ports that are vented to the atmosphere to relieve any vacuum or negative pressure. All back flow devices must be installed so they are accessible for inspection and repair.

All mechanical devices are required to be certified by the American Society of Sanitary Engineers (ASSE).

The level of hazard is a consideration in the selection of the appropriate device.

> **High Hazard** situations exist when there is an actual or potential connection for any toxic or infectious substance (contaminant) to be introduced into the water supply and may create a danger to health. Examples of contaminants include pesticides, chemicals, and infectious microorganisms.

> **Low Hazard** situations exist when there is an actual or potential connection for a nontoxic substance (pollutant) to be introduced to the water supply and create a nuisance or be aesthetically objective to the water user. Examples of pollutants are turbidity, beverages, and food coloring.

Hose Bib Vacuum Breaker: ASSE – 1011 (high or low hazard)

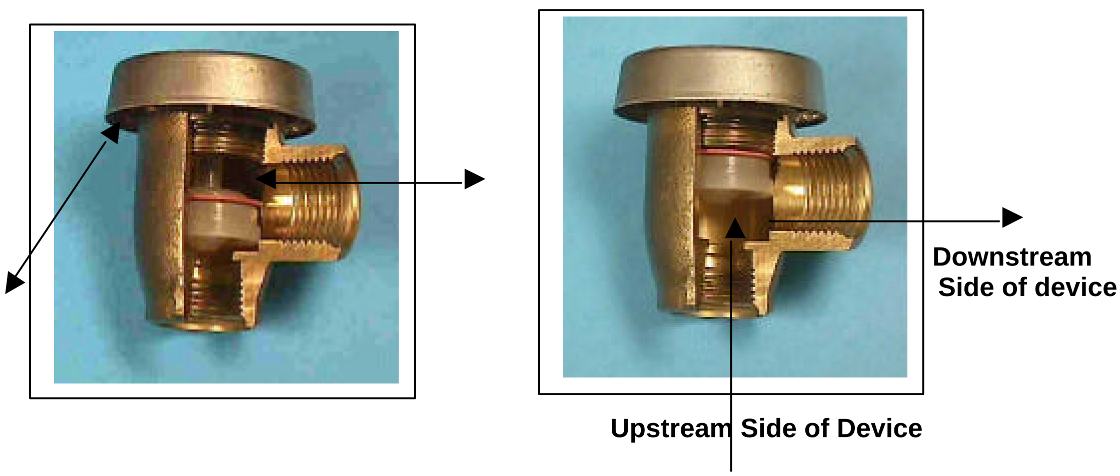
A hose bib vacuum breaker is installed on the end of a hose bib (sill cock, boiler drain, etc.) or anywhere a hose can be connected. It contains one spring loaded valve and an atmospheric vent that is controlled by a diaphragm seal. Installation & Use:

1. Shut-off valves must be located upstream from the vacuum breaker. Spring-loaded shut-off spray valves must be removed when the hose is not in active use.

2. Each hose connected to a manifold or “Y” must be provided with its own device (i.e. county fairs, special events, etc. where several vendors may share one hose spigot).

3. Approved for high hazards, non-continuous pressure, and no potential backpressure.

Atmospheric Vaccum Breaker: ASSE – 1001 (high or low hazard)



The water supply serving the device in the upper left photo is turned off which allows the float valve to be in the “closed” position drawing in open air (arrows show air movement). The water supply in the upper right photo is turned on and shows the float valve in the “open” position (arrows show direction of water flow).

This device has an internal polyethylene or metal float valve that moves up and down on a shaft (not spring loaded). When the water is turned on, water moving in the normal open direction of flow lifts the float and causes the atmospheric vent to close (see “Open Position”). Shutting off the water causes the float to drop, the supply valve to close, and the atmospheric vent is opened (see “closed position”). When a negative pressure occurs on the supply side, the float valve drops, closing off the supply, and opening the atmospheric vent. Installation and Use:

1. The mushroom shaped device must be installed vertically. The unit must be elevated at least 6 inches above the highest source of contamination “downstream” of the unit.

2. All shut-off valves must be located "upstream" of the unit. The reason for this is that a valve located downstream of the unit maintains the device under constant pressure and the float valve in the open position. Over time, the float valve can stick in the open position and fail to prevent backflow. The unit cannot be tested after installation.

3. Approved for high hazards, noncontinuous pressure, and no potential for backpressure.

Pressure Vacuum Breaker: ASSE – 1020 (high or low hazard)

The pressure vacuum breaker is similar to the atmospheric vacuum breaker except that it has two test cocks and two gate or ball valves for testing the unit. It also has two positive seating (spring loaded) valves. The first check valve (supply side) is spring loaded for a closed position and "guards" the potable water side. When the water is turned on, the flow pushes it in the open position. The second check valve or air inlet valve (downstream side) is spring loaded for an open position to the atmosphere and only closes when the supply water is turned on. When the supply pressure drops below atmospheric pressure, the second check valve opens to the atmosphere and the first check valve closes. The device only provides protection against backsiphonage. Installation and use:

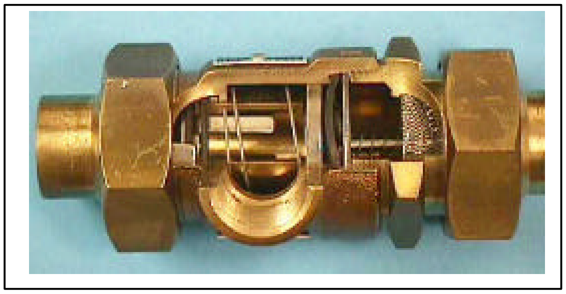
1. The unit must be installed at least 12 inches above the highest elevated inlet or fixture on its downstream side. The unit must have a shut-off valve on each side and two test cocks for testing.

2. The device must be located to be accessible for testing and servicing.

3. The unit is approved for high hazard, continuous pressure, and no backprssure potential. Valves may be located on the downstream side.

Backflow Preventers with Intermediate Atmospheric Vent: ASSE - 1012 and ASSE – 1022 (low hazard)

ASSE – 1012



ASSE – 1022

Used for carbonated beverages.

This device contains an atmospheric vent between two spring loaded check-valves. The valves close automatically under no-flow conditions. The atmospheric vent is controlled by a diaphragm seal that directly responds to the movement of the supply side of the check valve. As the water flow begins, the primary check opens and simultaneously frees the diaphragm seal to close off the atmospheric vent and then proceeds to open the secondary check valve (downstream side). The positive supply pressure holds the diaphragm seal in place to close off the atmospheric vent.

When zero pressure or back-siphonage conditions exists on the supply side, the primary check-valve closes under spring pressure and simultaneously pushes the diaphragm seal into position to form a tight seal between the valve and valve seat – opening the atmospheric vent and closing the secondary check valve.

Under backpressure conditions, the secondary check valve would close first. If the secondary check valve were to foul in the closed position, the primary check valve would close and the backpressure leakage would drain out through the atmospheric vent.

The ASSE 1022 device shown above includes an optional line filter (black add-on attachment).

Installation & Use:

1. The unit can be installed horizontally and vertically and must not be located in a pit or a location subject to standing water. Under no circumstances can the relief port be plugged.

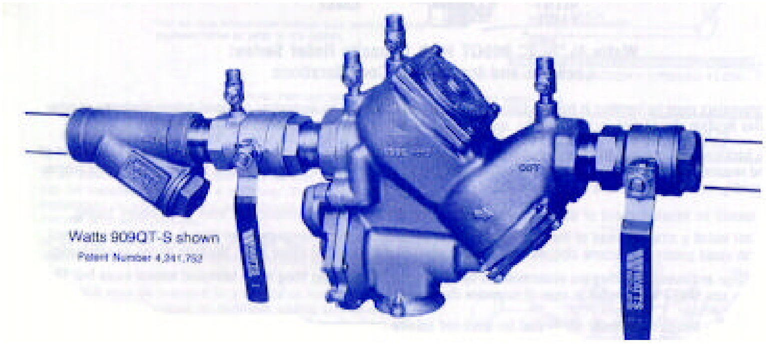
2. Michigan code limits the use of this device for protection of low pressure untreated boilers (below 15 psi), carbonated beverage dispensers, and other low hazard applications.

3. Valves may be located downstream of this device.

Double Check Valves: ASSE – 1015 (low hazard)

A double check valve backflow preventer consists of two check valves that are spring loaded in the closed position. The device does not have the added protection of an atmospheric vent and therefore is limited to the amount of protection it affords and how it can be used. Some codes and jurisdictions do not allow double check valves to be used for backflow protection.

Reduced Pressure Zone Backflow Prevention Assembly (RPZ): ASSE – 1013 (high or low hazard)



This type of mechanical device provides the maximum protection against both backsiphonage and backpressure. Construction of the RPZ consists of two very sensitive and independent spring loaded check valves with a “reduced pressure zone” between them (at least 2 psi pressure differential from the supply pressure). The check valves are spring loaded to automatically close unless they are held open with the flow in the proper direction. As the water passes through the primary check valve, the water pressure will drop in the reduced pressure zone chamber (due to friction). Under normal conditions, the water will then continue on through the secondary check valve to the point of usage.

The reduced pressure zone contains a relief valve that drains to the atmosphere and is spring loaded for an automatic open position. The relief valve has the reduced pressure zone water on one side and the water supply pressure on the other side. To keep the relief valve closed, the supply pressure must exceed the RP zone pressure. Thus, it will spring open under any conditions causing the water pressure in the RP zone to approach or exceed the supply pressure. Also, when the relief valve opens, an air passage from the atmospheric vent is opened to satisfy any backsiphonage conditions. So, even if both check valves are fouled, the relief valve will continue to protect the supply. Installation and use:

1. Under no circumstances should the relief port be plugged.

2. The RPZ is equipped with test cocks and gate valves for testing.

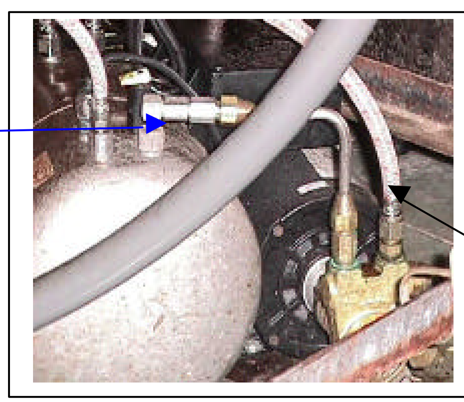
3. The unit must be accessible for testing and service.

4. Approved for high hazards, continuous pressure, backpressure, and back-siphonage.

5. The unit may have valves located downstream and may be located lower than the potential source of contamination

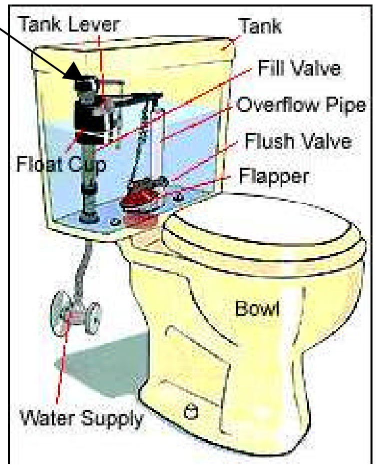
6. The relief port drain must be discharged by means of an air gap to a drain.

Dual Check-Valves at Carbonator: ASSE-1032 (low hazard)



The water supply connection to carbonated beverage dispensers shall be protected against backflow by a double check valve with an intermediate atmospheric vent conforming to ASSE 1012 or ASSE 1022. The double check valve with an intermediate atmospheric vent device and the piping downstream therefrom shall not be effected by carbon dioxide gas. Secondary protection in the form of a dual check valve conforming to ASSE 1032 shall be installed on the beverage dispensing equipment.

Anti-siphon-type Water Closet Flush Tank Ballcock: ASSE- 1002 (low hazard)



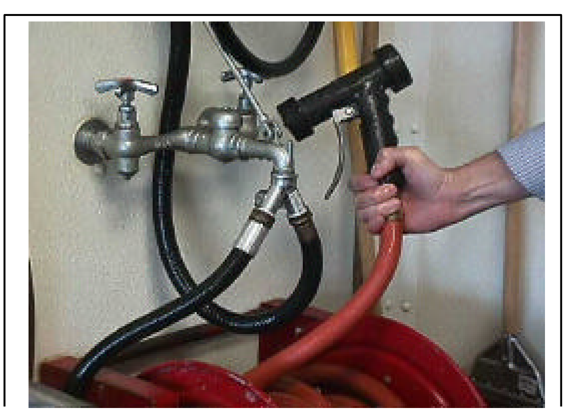
Installation and Use: Ballcock assembly must be installed above the overflow pipe high water level.

<u>Typical Food Service Establishment Water Supply Cross-Connections</u>

1. **Pre-rinse or pre-flush hose:** This device is typically located at garbage grinders, mechanical dishwashing machines, and vegitable prep sinks. A spring normally keeps the end of the hose above the sink flood rim level to form an air gap. Worn springs allow the end of the hose to fall below the rim.

2. **Lack of a hose bib vacuum breaker on hose connections:** Common locations for this problem are at janitor sinks, steam kettles, and outdoor faucets.

3. **Valve installed at the end of a hose utilizing an atmospheric vacuum breaker for protection:** Correction involves either the removal of the valve or the installation of a pressure vacuum breaker.



4. **Inlets which are or may become submerged:** Common problem areas may include submerged inlet in the toilet tank, garbage grinder, sink faucets, lawn irrigation system, hoses, water inlet to steam table / baine marie, water-cooled equipment discharged below flood rim of drain, water softening equipment, and chinese range.

5. **Boilers:** Lack of protection for boilers that may be associated with building heating systems, food steamers, steam kettles, tilting skillets, and espresso machines. Approved backflow protection includes:

   a. Boiler with no chemicals added: An in-line backflow protection device with an intermediate atmospheric vent for continuous pressure and potential backpressure.
   b. Boiler with chemicals added: An RPZ backflow protection device or air-gap.

Air Gaps & Air Breaks for Drains & Waste

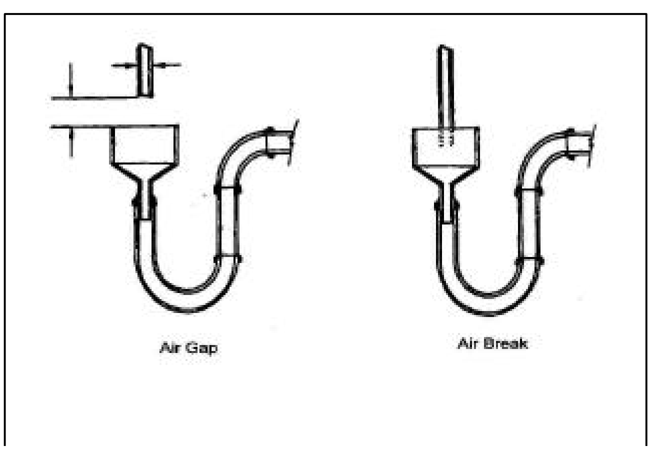
An indirect connection between food service equipment and the facility's drainage or wastewater disposal system is necessary to prevent waste water from backflowing into equipment where food, kitchenware, or utensils are retained.

Direct wastewater connection: A waste line or pipe from a fixture, receptable, or device that discharges used water, waste materials, or sewage directly into the facilities drainage system.

Indirect wastewater connection: A waste line or pipe from a fixture, receptable, or device that discharges used water, waste materials, or sewage into the facilities drainage system through an "air gap" or "air break".

Air Gap: is the unobstructed vertical space that separates the end of a supply line and the flood rim of a receptacle. The air gap must be the greater of either a minimum of one inch or twice the diameter of the supply pipe/

Air Break: is a waste line or pipe from a fixture that discharges used water or liquid waste into another fixture or receptacle at a point below the flood rim level.

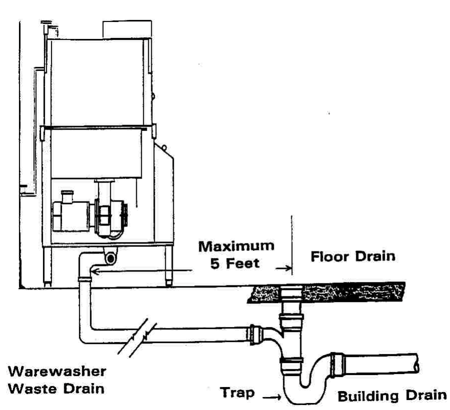


Examples of food service equipment requiring an **Air Gap:**

- Relief valve for booster heater / water heater.
- Water-cooled condensers typically found at some ice machines or other refrigeration systems.
- Drain lines for food service equipment such as salad bar, ice machine, ice bin, cobra cup holder, steam kettle and steam table.
- Any sink compartment or equipment (i.e. ice cream dipper well) used for food.
  Note: Food sinks and equipment installed before 4/1/85 can have a direct connection until replaced.
- Brine tank drains from water softening equipment.
- Walk-in cooler floor drains that vertically discharge, as is typically found in a basement.

Examples of food service equipment requiring only an **Air Break:**

- Floor drains in a walk-in cooler, provided a flapper valve is installed in the horizontally discharging drain line, such as is typically found in slab construction when a drain line discharges to a floor drain.
  Note: Vertical discharges must be air-gapped.
- Warewashing machines. An alternative is to direct connect the drain if there is a floor drain within 5' as shown below.



Examples of food service establishment plumbing devices that are allowed or required to have a **direct wasteline connection** to the facility's drainage system.

- **Direct Connection Required:** Sinks connected to grease interceptors (traps) and garbage grinders.

- **Direct Connection Allowed:** Hand sinks and warewashing equipment such as pot sinks and 3-compartment sinks. Warewashing machines may have a direct connection if there is a floor drain within 5' as shown above.

Notes:
1. If any compartment of a warewashing sink is used for culinary purposes, then that sink compartment must be air-gapped.
2. While directly connecting warewashing equipment is allowed, better public health protection is achieved by providing an indirect connection.
3. When a garbage grinder is installed in a sink, a direct connection is required and that sink can not be used for food.